Prioritizing Alien Plants and Invaded sites for Inventory and Monitoring

Introduction:

As is the case for inventory and monitoring of most biological resources in parks, it will not be possible to inventory all alien species at the scale and intensity you may like, or to monitor all alien species at all places. As most alien species are not respecters of political boundaries, one may also have to decide where and how much of a park's environs need to be inventoried and monitored. It may be difficult to just monitor priority species at all the places desired at the intensity considered optimal. Yet we wish to insure that the monitoring data we collect is scientifically and statistically valid and that the data provides information valuable towards management.

Prioritizing species and places for monitoring may be one of the most difficult steps in the protocol development process.

Prioritization must be based upon a defendable process and on objective and consistently applied criteria. Priorities will vary temporally and spatially and will vary based upon the management objectives. Inventory priorities may differ from monitoring priorities and may, to some extent, dictate monitoring priorities.

Chapter 3 of Measuring and Monitoring Plants (1998) addresses the issue of prioritization of rare species for monitoring. The authors suggest steps in the process that certainly apply or could be modified to apply to the prioritizing alien plants for monitoring.

There have been multiple systems developed to predict the invasiveness of alien species and to prioritize or categorize species already present for management. I am aware of 2 systems that have been developed to prioritize sites/places for management of alien species. None of these systems were developed to set priorities for inventory and monitoring. However, I feel they can be utilized.

Priorities for species and places will vary depending upon the objectives (e.g. early detection and prevention, trends over time, effectiveness of control programs).

Finally, we must always remember the purpose of managing and thus monitoring invasive plants is to determine impacts being caused to the system of concern, and/or the recovery of the system due to management action.

In this paper I will briefly address setting priorities for inventory, suggest modifications of steps and criteria in Chapter 3 of Measuring and Monitoring Plants, describe 2 systems for ranking species and how they can be used/modified to set priorities for monitoring, and describe 1 system for ranking places.

INVENTORY

Inventory information is the foundation for setting monitoring priorities. Most networks have addressed priorities for inventory and are now implementing their programs. Searches have/are being done on historic occurrences of alien species, supporting research, and gaps are being identified. In some cases, it has been determined that to complete inventories with the funds and the time allocated, only presence/absence data can be collected. Other networks have given high priority to alien plant inventory and are gathering data on distribution and abundance and maps of selected species. Many parks have accompanied inventory with an assessment of impacts caused by species and have ranked species for management. All of the above provide valuable information to be applied towards ranking species and places for monitoring. A solid investment in inventory can provide information to guide a focused monitoring program which addresses the most serious threats.

Modifying Measuring and monitoring plant populations

A set of criteria have been developed for ranking rare species for monitoring. These then are put in a matrix format to compare species for management. I assume this approach could also be used to rank places for inventory and monitoring. Of note, both biological and managerial considerations are included in the criteria. This is the reality we operate in.

As an exercise, I have gone through the criteria for prioritizing rare species and suggested modifications for alien species.

Rank: Is the species known to be a problem elsewhere? Is it on the National list? Is it on a state list? Has it ranked high using APRS in one or more parks in the network?

Rarity: Change to abundance & distribution. In How many parks does it occur , how many habitat types, what is the density?

Taxonomic Distinctiveness: This criteria may not fit invasive plants

Sensitivity to threats: Change to impact and threat. What is the species doing to the systems you are trying to protect? Are ecosystem processes impacted? Are T&E species, special communities, species composition, habitat structure impacted?

Known declines: Change to rate of increase in density and in area occupied.

Extent of threats: Valid criteria as is. May be redundant with distribution and abundance.

Immediacy of threats: For invasives, this is a management issue. However, monitoring should be closely related to management. This deals with urgency of action and the cost of delay in taking management action.

Conflict: Good criteria for invasives. For example, control of tamaris and willow flycatcher habitat. Possible conflict with other management objectives.

Monitoring Difficulty: Solid criteria for invasives.

Availability of Management actions: Good criteria. Is the technology available for control? Is it feasible to restore the system that has been invaded?

Recovery potential: Good criteria for invasive plants.

Public interest: Secondary consideration

Potential for Crisis: Good criteria.

The next set of criteria are for ranking same species populations. Some thought will be required to modify these criteria for places but the next step as presented should work at least for single species considerations. Criteria include populations size, population viability, population location, habitat quality, unique habitat, previous information, special management area. These can be modified by definition for alien species. Other considerations should include source population, and feasibility of control and recovery of the system.

Once one has ranked/prioritized/categorized alien species, it is very likely that more high priority species and locations have been identified than can be monitored with the resources at hand. The next step is to estimate the resources needed and the resources at hand and go back and modify the scale and intensity as needed.

The chronology of steps should be: Inventory>rank management priorities>rank species> rank places>desired scale and intensity> resources available> feedback

Notice that I have included another factor to rank, management priority. What are your priorities for management? Prevention, early detection, reduce spread, control, eradicate, or restore habitat. Management priorities will definitely influence which species at which places will have highest priority for management and thus for monitoring.

Systems developed to rank species for management

Two systems that have been developed to rank invasive species are described below. Neither system was developed to rank alien species for monitoring but they can be utilized/modified for that purpose.

Alien Plant Ranking System (APRS)

This system was developed to rank species for management within a site/park. It has, however, been modified to rank species at larger scales. For example, the State of Minnesota used the system not only to rank alien plants but animals also. The system is also included the State of Colorado handbook produced by Eric Lane and others.

The system has undergone much testing and review and now can be found at the Southwest Exotic Plant Information Clearinghouse web site (http://wapiti.wr.usgs.gov/swepic/aprs/pages/ranking.htm). The system, or a modification thereof, has been used to rank species in parks across the country. It is also recommended for use by the Exotic Plant Management Teams. We have tried to harvest most of the information which is now included in associated databases on the web site.

The system includes biological, stochastic, and extrapolation criteria to rank species. It also is purposely divided into 3 distinct sections which makes it easier to modify based upon ones purposes for ranking, e.g. monitoring.

I Significance of threat or Impact
- A. Distribution relative to disturbance regime
- B. Aerial extent of populations
- C. Numerical Dominance of species within a community
- D. Association with native community
- E. Degree of threat and impact
- F. Effects on Management Goals

II. Innate Ability to be a pest
- A. Mode of reproduction
- B. Vegetative reproduction
- C. Frequency of sexual reproduction
- D. Number of seeds per plant
- E. Dispersal Ability
- F. Germination requirements
- G. Seed banks
- H. Competitive ability
- I. Ecological effects
- J. Known level of impact in natural areas

III. Feasibility of Control
- A. Likelihood of successful control
- B. Saturation in surrounding region
- C. Effectiveness of community management
- D. Vegetative regeneration
- E. Biological control
- F. Side effects of control measures

Species can be ranked for each category separately, combining any 2, or all 3. Species profiles are generated for each species.

The system does not need to be modified to apply towards setting monitoring goals. However, the weight given to sections and to particular questions may differ depending on the monitoring goal. Take for example, your management priority is prevention/early detection.

I. Significance of threat or impact: High weight should be given to distribution relative to disturbance regime (elsewhere, adjacent park), low or 0 extent, dominance within site. High weight would be given to Degree of threat and effects on management goals.

II. Innate ability to be a pest: This section in general would be given high weight relative to sections I and III. This requires inventory information on the presence of the species near the park/network, corridors and vectors for spread, and the probability of the species becoming introduced into the park/network.
III. Feasibility of Control: This section could be ignored or used as a secondary consideration compared to Section II. That is, you consider how difficult it will be able to control this species if you are not successful in prevention or early detection and eradication.

If your priority is to monitor invasive species for the effects of management, the system or weights given various criteria requires little or no modification.

Categorizing Alien Plant Species that Threaten Native Biodiversity

This system is being developed by John Randall, TNC, Larry Morse and Nancy Benton, Nature Serve, and Ron Hiebert, NPS. The system differs in intended scale and purpose from APRS.. The intended scale is national but it is being applied (in modified form) at the state level in California and Virginia. It could feasibly be applied at the network scale. Its general purpose is to categorize all alien species in the U.S. into one of 4 categories: high, medium, low, and insignificant threat to native biodiversity in wildlands. The purpose is to draw attention to those species ranked as high or medium based upon a consistent and objective application of criteria. Attention includes research, control, prevention, public awareness, monitoring, etc.

The system asks questions about each species in 4 categories.

I. Impact on native species habitats and ecosystems
II. Current distribution in the region of interest
III. Potential to spread/increase beyond current distribution and abundance.
IV. Difficulty of management

This system is recommended to identify species to be mapped, and as the baseline list of species to be considered for inclusion in a networks invasive plant monitoring program.

Prioritizing Places

The country of New Zealand is quite zealous about there management of alien species. They have an intensively applied screening program to decide if a new species should be allowed to be introduced into the country and a strategic plan for control of weeds in their many natural areas. They set priorities for management based upon a weed-led and a site-led program. The systems work in tandem. It should be noted that they give high weight to the practicality of control. The paper describing the system (Timmons and Owens, 2001) can be found in Appendix A.

The Weed-led program considers similar attributes as the 2 systems described above. Steps in application include:

1. Determine if the weed species meets criteria for a weed-led program by use of a dichotomous flow chart.
2. Calculate weed's biological success (capacity)
3. Calculate weed's effect on system score (impact)
4. Calculate weediness score (=biological success + 2X effect)
5. Assess practicality of control
6. Derive a priority ranking

The Site-led program is based upon the conservation value of sites, the level and urgency of threat, the weed species present, and the practicality of control.

Steps in the process are similar to the weed-led program. They are:

1.Score unit for botanical value
2. Score site for wildlife value
3. Identify the biodiversity value (higher of the botanical or wildlife value).
4. Identify the significant weeds at the site
5. Access the site and suite of weeds urgency (national extinctions, local extinctions, reduction of biodiversity in near future, etc)
6. Derive a priority ranking score: Biodiversity score X urgency of control score

How can you modify the system to prioritize places for monitoring? Maybe you don't have to. As long as monitoring priorities are closely aligned with management priorities, one system can serve both purposes. Again, if priority is prevention and early detection, those sites of highest biodiversity value which are threatened by known highly invasive plants should be given priority.

Summary

Prioritization of species and places is a must in the design of a network invasive plant monitoring program. As monitoring should reflect management priorities, tools to help determine management priorities should be effective in ranking species and places for

vital signs monitoring. Both managerial and biological consideration should be employed.